

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	IB Docket No. 02-10
Procedures to Govern the Use of Satellite)	
Earth Stations on Board Vessels in the 5925-)	
6425 MHz/3700-4200 MHz Bands and 14.0-)	
14.5 GHz/11.7-12.2 GHz Bands.)	
To: The Commission		

**CONSOLIDATED REPLY TO OPPOSITIONS AND
COMMENTS OF THE BOEING COMPANY**

R. Craig Holman
Counsel
The Boeing Company
Connexion by Boeing
P.O. Box 3707, MC 14-07
Seattle, WA 98124-2207
(206) 655-5399

Philip L. Malet
Carlos M. Nalda
Steptoe & Johnson LLP
1330 Connecticut Ave., N.W.
Washington, D.C. 20036
(202) 429-3000
Counsel for The Boeing Company

May 4, 2005

SUMMARY

In this Consolidated Reply to Oppositions and Comments, The Boeing Company (“Boeing”) addresses further a number of issues associated with the Commission’s recent Order establishing rules and procedures governing the operation of earth station onboard vessels (“ESVs”) that require reconsideration or clarification to better promote the market-based deployment of ESV systems and service.

First, Boeing has urged the Commission to permit U.S.-licensed Ku-band ESVs to operate at off-axis e.i.r.p. spectral density levels above the traditional two-degree spacing values where the serving satellite has coordinated off-axis e.i.r.p. levels in excess of those values. All interested parties commenting on this issue agree with the proposal. Boeing further believes that a certification from an ESV applicant’s serving satellite operator should be sufficient to establish neighboring satellite operator acceptance of such higher power operations.

Second, Boeing has suggested that refinement of the Commission’s ESV tracking requirement similar to that adopted by the European Telecommunications Standards Institute working group on ESVs may be appropriate. Specifically, a tracking error threshold ($\delta\phi$) should be incorporated into the off-axis e.i.r.p. requirement such that the off-axis mask is lowered in proportion to $\delta\phi$, but the Commission should treat a tracking error of 0.2 degrees or less as *de minimis* and ignore it for purposes of reducing the ESV off-axis e.i.r.p. spectral density mask. Related to this, the Commission should increase the permissible response time to detect and react to an ESV pointing exceedance to a level that is technically feasible.

Third, in the *ESV Order*, the Commission adopted Boeing’s suggested approach for routine licensing of ESV operations on the basis of off-axis e.i.r.p. spectral density levels. In subsequent filings, a lone suggestion to the contrary has been submitted. Boeing point out that

there is no basis in the record and it would be contrary to the public interest to alter the Commission's approach to ESV blanket licensing by instead adopting separate antenna gain and input power requirements for ESV antennas.

Finally, Boeing has requested that the Commission clarify certain language in the *ESV Order* that appears to require division of aggregate power density (and thus available data rate capacity) evenly among all simultaneously transmitting terminals. Such a requirement would preclude a bandwidth-on-demand ESV system, such as that contemplated by Boeing, because it does not account for the varying capacity needs of individual ESV terminals. Boeing believes that the Commission's rules should facilitate the implementation of such advanced ESV systems, but that it is incumbent on an ESV applicant to demonstrate adequately how it will comply with the off-axis e.i.r.p. spectral density mask and other ESV rules.

TABLE OF CONTENTS

Summary	i
I. ESVS SHOULD BE PERMITTED TO OPERATE IN ACCORDANCE WITH THE COORDINATED PARAMETERS OF THEIR SERVING SATELLITES.....	3
II. THE COMMISSION SHOULD MODIFY ITS ANTENNA POINTING ACCURACY REQUIREMENTS FOR ESV OPERATIONS	6
III. THE COMMISSION SHOULD NOT ALTER ITS OFF-AXIS E.I.R.P SPECTRAL DENSITY APPROACH FOR ESV BLANKET LICENSING	9
IV. THE COMMISSION SHOULD CLARIFY THE CALCULATION OF AGGREGATE OFF-AXIS E.I.R.P. DENSITY OF ESV TRANSMISSIONS.....	10
V. CONCLUSION	12

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	IB Docket No. 02-10
Procedures to Govern the Use of Satellite)	
Earth Stations on Board Vessels in the 5925-)	
6425 MHz/3700-4200 MHz Bands and 14.0-)	
14.5 GHz/11.7-12.2 GHz Bands.)	

To: The Commission

**CONSOLIDATED REPLY TO OPPOSITIONS AND
COMMENTS OF THE BOEING COMPANY**

The Boeing Company (“Boeing”), by its attorneys and pursuant to Sections 1.4(b)(1) and 1.429 of the Commission’s Rules,¹ hereby submits its Consolidated Reply to Oppositions and Comments in the above-captioned proceeding regarding the use of earth stations on board vessels (“ESVs”).² In this submission, Boeing addresses the Partial Opposition and Comments of PanAmSat Corporation, the Opposition and Comments of Intelsat, Ltd. and the Consolidated Opposition and Comments of Maritime Telecommunications Network, Inc. on Petitions for Reconsideration and Clarification.³

¹ 47 C.F.R. §§ 1.4(b)(1) & 1.429.

² See Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands, *Report and Order*, IB Docket No. 02-10, FCC 04-286 (rel. Jan. 6, 2005) (“*ESV Order*”).

³ See Partial Opposition and Comments of PanAmSat Corporation (filed April 21, 2005) (“PanAmSat Opposition”); Opposition and Comments of Intelsat, Ltd. (filed April 21, 2005) (“Intelsat Opposition”); Consolidated Opposition and Comments of Maritime Telecommunications Network, Inc. on Petitions for Reconsideration and Clarification (filed April 21, 2005) (“MTN Opposition”).

Boeing generally is very supportive of the actions taken by the Commission in this proceeding, but submitted a Petition for Partial Clarification or Reconsideration that requested certain changes in the *ESV Order* to promote a regulatory regime that more fully advances the goals for market-driven deployment of satellite-based broadband technologies in the maritime sector.⁴ Specifically, Boeing requested clarification or reconsideration of the following issues: (i) the ability of ESVs to operate with off-axis e.i.r.p. spectral density higher than the Commission's two-degree spacing levels if consistent with the coordinated parameters of the serving satellite; (ii) the methodology for calculating the aggregate off-axis e.i.r.p. spectral density of simultaneously transmitting ESVs; (iii) the response time associated with ESV tracking accuracy exceedance; and (iv) the establishment of a demarcation line for prior agreement for foreign-licensed Ku-band ESV operations beyond the 125 km minimum distance specified in Resolution 902, and requiring prior agreement throughout the 14.0-14.5 GHz band even though the United States is listed as a "potentially concerned administration" with respect to the 14.4-14.5 GHz band only.

In its Consolidated Opposition to Petitions for Reconsideration or Clarification and Comments, Boeing also (i) proposed an alternative ESV pointing accuracy requirement based on the approach adopted by the European Telecommunications Standards Institute ("ETSI") working group on ESVs; and (ii) urged that Commission to maintain the off-axis e.i.r.p. spectral density approach for ESV blanket licensing adopted in the *ESV Order*.⁵

⁴ See Petition for Partial Clarification or Reconsideration of The Boeing Company (filed March 2, 2005) ("Boeing Petition").

⁵ See Consolidated Opposition to Petitions for Reconsideration or Clarification and Comments of The Boeing Company (filed April 21, 2005) ("Boeing Opposition").

In this submission, Boeing addresses further the issues of higher power ESV transmit operations, ESV pointing accuracy requirements, ESV blanket licensing based on compliance with an aggregate off-axis e.i.r.p. spectral density mask and calculation of aggregate off-axis e.i.r.p. spectral density of simultaneously transmitting ESVs. As discussed herein, Boeing's proposals with respect to these issues constitute reasonable compromise positions that will facilitate the development and deployment of ESV networks, while at the same time ensuring appropriate interference protection for co-frequency FSS operations and other users of the spectrum.

I. ESVS SHOULD BE PERMITTED TO OPERATE IN ACCORDANCE WITH THE COORDINATED PARAMETERS OF THEIR SERVING SATELLITES

As discussed in the Boeing Petition, the Commission should permit U.S.-licensed Ku-band ESVs to operate at off-axis e.i.r.p. spectral density levels above the traditional two-degree spacing values where the serving satellite has coordinated off-axis e.i.r.p. levels in excess of those values.⁶ Specifically, Ku-band ESV systems should have the flexibility to transmit at higher power levels (up to the levels included in Resolution 902) for operations in regions where two-degree spacing is not the norm and operator-to-operator coordination is relied on to establish adjacent satellite interference limits;⁷ and where ESV transmissions in excess of the routine off-axis e.i.r.p. values can be coordinated with adjacent satellite operators in a two-degree spacing environment.⁸ U.S. ESV applicants should be allowed to establish consistency with applicable coordination agreements by filing a certification from the serving satellite operator that any higher-power off-axis e.i.r.p. levels have been accepted by adjacent satellite systems through the

⁶ See Boeing Petition at 3-16.

⁷ *Id.* at 8-12.

⁸ *Id.* at 12-14.

coordination process.⁹ By permitting higher-power Ku-band ESV operations in the manner proposed by Boeing, the Commission can preserve operational flexibility for ESV licensees while fully protecting the interests of potentially affected parties.

Intelsat, MTN and PanAmSat (with the limited exception discussed below) support Boeing's request for reconsideration to permit higher power ESV operations consistent with the coordinated parameters of the serving satellite.¹⁰ Because there is general consensus among ESV proponents and FSS space station operators alike, the Commission should reconsider its decision on higher power ESV transmit operations as proposed by Boeing.

In its Opposition, PanAmSat states that it disagrees with certain elements of the manner in which Boeing seeks to implement higher power ESV operations. First, PanAmSat suggests that there are a wide range of orbital spacings in other regions of the world and that characterizing parts of the geostationary arc as a three-degree spacing environment may inadvertently subject more closely spaced satellites to unacceptable interference.¹¹ Boeing agrees with PanAmSat that the Commission should not permit U.S.-licensed ESVs to transmit at three-degree spacing levels (the maximum levels permitted in Resolution 902) without regard to the coordinated levels of the serving satellite. This is precisely why Boeing suggested limiting ESV transmit power levels to those accepted by neighboring satellite operators (within six degrees of the serving satellite) in the context of operator-to-operator coordination. Boeing's characterization of the U.S. domestic arc (where two-degree spacing is the norm) and international arc (where two-degree spacing is not the norm) was to distinguish the circumstance

⁹ *Id.* at 14-16.

¹⁰ Intelsat Opposition at 10-14; MTN Opposition at 3, n.7.; PanAmSat Opposition at 7-9.

¹¹ *See* PanAmSat Opposition at 7.

where adjacent satellite operators rely primarily on the Commission's Part 25 rules rather than operator-to-operator coordination in order to avoid harmful interference. In any event, there is no real disagreement between Boeing and PanAmSat on this point.

PanAmSat also suggests that the Commission should require ESV applicants seeking to conduct higher power ESV operations with a U.S. satellite to submit affidavits from neighboring U.S. satellite operators, rather than accepting a serving satellite operator's certification as proposed by Boeing, to establish neighboring operator agreement with such higher power operations.¹² The Commission recently addressed this very issue in the context of revising analogous rules governing non-routine earth station operations.¹³ In that decision, the Commission concluded that earth station applicants need only submit certifications from their serving (target) satellite operators that the proposed non-routine operations have been coordinated with neighboring satellite operators.¹⁴ The Commission should impose the same requirement in the context of non-routine ESV operations and reject the alternative neighboring operator affidavit requirement proposed by PanAmSat.

¹² *Id.* at 8-9.

¹³ See 2000 Biennial Regulatory Review Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations; Amendment of Part 25 of the Commission's Rules and Regulations to Reduce Alien Carrier Interference Between Fixed-Satellites at Reduced Orbital Spacings and to Revise Application Procedures for Satellite Communication Services, *Fifth Report And Order In IB Docket No. 00-248 and Third Report And Order In CC Docket No. 86-496*, FCC 05-63 (rel. March 15, 2005).

¹⁴ *Id.* at ¶¶ 44-52.

II. THE COMMISSION SHOULD MODIFY ITS ANTENNA POINTING ACCURACY REQUIREMENTS FOR ESV OPERATIONS

In its Petition, Boeing suggested that refinement of the Commission's ESV tracking requirement similar to that adopted by the ETSI working group on ESVs may be appropriate in the context of the timing constraint associated with the ESV tracking error rule.¹⁵ Boeing also noted that in section 4.2.3.2 of Draft ETSI EN 302 420, a tracking error threshold ($\delta\phi$) is incorporated into the off-axis e.i.r.p. requirement such that the off-axis mask is lowered in proportion to $\delta\phi$.¹⁶ In its Opposition, Boeing further proposed that the Commission treat a tracking error of 0.2 degrees or less as *de minimis* and ignored for purposes of reducing the ESV off-axis e.i.r.p. spectral density mask.¹⁷ Both Intelsat and PanAmSat commented on Boeing's proposal.

Boeing agrees with Intelsat that the existing ESV off-axis e.i.r.p. mask does not and should not separately account for pointing error by reducing allowable power levels.¹⁸ The underlying assumption of the ESV off-axis e.i.r.p. mask, and the Commission's earth station licensing rules generally, is that the pointing error is small and thus need not be taken into account. Furthermore, as Intelsat points out, the 0.2 degree pointing accuracy requirement in Resolution 902 is an independent requirement that is meant to quantify the assumption that pointing error is small for ESV networks.¹⁹ Boeing also believes that incorporating the 0.2 degree pointing error into the ESV off-axis e.i.r.p. mask would unnecessarily penalize ESVs

¹⁵ See Boeing Petition at 20-21.

¹⁶ See *id.* at 21.

¹⁷ See Boeing Opposition at 4-6.

¹⁸ See Intelsat Opposition at 16-17.

¹⁹ *Id.* at 17, n.49.

relative to other FSS earth stations. As set forth in the Boeing Opposition, larger pointing errors can be accommodated in the aggregate by adjusting the off-axis e.i.r.p. mask.

Boeing disagrees, however, that merely shifting the gain or density mask by $\delta\theta$ as suggested by PanAmSat is substantially simpler than the approach proposed by Boeing.²⁰ Including stated ESV pointing errors of greater than 0.2 degrees in an off-axis e.i.r.p. reduction is neither complicated nor difficult to administer from a regulatory perspective. In addition, when consistent with U.S. policy, there is value in having ESV requirements in various regions of the world closely aligned (*e.g.*, U.S. and European pointing accuracy requirements). Boeing also believes that its suggested approach to ESV pointing accuracy constitutes a reasonable accommodation between the initial proposal of ARINC to eliminate the pointing accuracy requirement entirely and PanAmSat's request for an absolute 0.2 degree pointing accuracy limitation,²¹ and is in line with PanAmSat's evolved views and Intelsat's comments that small pointing errors need not be taken into account in defining the ESV off-axis e.i.r.p. spectral density mask.

On a related matter, in its Opposition, PanAmSat criticizes Boeing's proposal with respect to increasing the permissible response time to detect and react to ESV pointing exceedances to a level that is technically feasible. As noted in Boeing's Petition, the requirement in Section 25.222(a)(7) to automatically cease ESV transmissions is somewhat vague because it does not specify the point of reference from which the time permitted for automatic cessation (100 milliseconds) is measured. In light of current ESV tracking technology and techniques, Boeing requested that the Commission extend this period from 100 milliseconds to three seconds

²⁰ See PanAmSat Opposition at 4-6.

²¹ See ARINC Incorporated Petition for Reconsideration (filed March 2, 2005); *see also* Petition of PanAmSat Corporation for Reconsideration or Clarification (filed March 2, 2005).

if measured from the time of the actual tracking exceedance, or to 200 milliseconds if measured from the time at which a tracking exceedance is detected. Boeing also noted that the ETSI approach permits response times of up to five seconds, with shut-down periods of twice the response time.²²

PanAmSat believes that the time for responding to a tracking exceedance must be measured for the time of actual exceedance (rather than detection), and opposes Boeing's proposed three-second response time and the ETSI approach.²³ However, PanAmSat does not offer an alternative proposal consistent with existing tracking and control technology. As explained in Boeing's Petition, the Commission's current requirement is simply not technically feasible. Boeing believes the alternatives proposed in its Petition provide the Commission with appropriate and technically feasible options that will facilitate the development and deployment of ESV networks while adequately protecting co-frequency FSS operations.

Finally, Boeing agrees with Intelsat that the start angle of the ESV off-axis e.i.r.p. spectral density mask should be extended to 1.5 degrees.²⁴ As noted by Intelsat, because ESV mispointing is limited to 0.2 degrees (and transmit powers may be reduced for pointing errors in excess of 0.2 degrees), there is no need to be overly conservative in selecting the start of the envelope so long as the point accuracy/power reduction requirements are enforced.²⁵ Boeing

²² See Boeing Petition at 18-21.

²³ See PanAmSat Opposition at 6.

²⁴ See Intelsat Opposition at 18-22.

²⁵ See *id.* Boeing would note, however, that Intelsat's suggestion that the ESV off-axis e.i.r.p. mask should be reduced to account for a 0.2 degree pointing error appears inconsistent with other statements in its Opposition that small pointing errors should be ignored in the off-axis e.i.r.p. mask, and that this element of Intelsat's pointing accuracy proposal may be in error. Compare *id. with id.* at 16-17.

supports Intelsat's proposal for the Commission to standardize the off-axis e.i.r.p. spectral density masks for traditional FSS earth stations and ESVs.

III. THE COMMISSION SHOULD NOT ALTER ITS OFF-AXIS E.I.R.P SPECTRAL DENSITY APPROACH FOR ESV BLANKET LICENSING

In the *ESV Order*, the Commission adopted Boeing's suggested approach for routine licensing of ESV operations on the basis of off-axis e.i.r.p. spectral density levels.²⁶ PanAmSat asked the Commission to reconsider this decision and instead adopt separate antenna gain and input power requirements for ESV antennas.²⁷ As discussed in the Boeing Opposition, PanAmSat presented insufficient reasons for altering the Commission's well-reasoned decision.²⁸

Intelsat and MTN agree. As Intelsat correctly notes, off-axis e.i.r.p. spectral density (the sum of off-axis antenna gain and input power density) is the earth station parameter that determines the amount of uplink interference caused to an adjacent satellite.²⁹ Thus, "there is absolutely no reason from an interference standpoint for placing separate limitations on the antenna input power and off-axis gain;" and "PanAmSat's proposal would serve only to limit ESV operator flexibility and discourage application of technical advances."³⁰ MTN similarly "cannot support PanAmSat's request to replace the off-axis e.i.r.p. density limits for ESVs with separate requirements for off-axis antenna gain and power density at the input of the earth station

²⁶ See *ESV Order* at ¶ 98-101.

²⁷ See Petition of PanAmSat Corporation for Reconsideration or Clarification (filed March 2, 2005) at 4-5.

²⁸ See Boeing Opposition at 6-9.

²⁹ See Intelsat Opposition at 15.

³⁰ *Id.*

antenna.”³¹ Thus, all other interested parties agree that the Commission properly concluded that ESV licensing on the basis of off-axis e.i.r.p. spectral density would serve the public interest and PanAmSat has providing no basis for the Commission to alter its conclusion.

IV. THE COMMISSION SHOULD CLARIFY THE CALCULATION OF AGGREGATE OFF-AXIS E.I.R.P. DENSITY OF ESV TRANSMISSIONS

In its Petition, Boeing urged the Commission to clarify how individual ESV transmissions may be taken into account in meeting the aggregate levels.³² Specifically, certain language in the *ESV Order* appears to require division of aggregate power density, and thus available data rate capacity, evenly among all simultaneously transmitting terminals (*e.g.*, the off-axis e.i.r.p. density of each of five transmitting ESVs would be limited by the same amount, in this case $10 \cdot \log(5)$ or 7.0 dB), which would preclude a bandwidth-on-demand ESV system, such as that contemplated by Boeing, because it does not account for the varying capacity needs of individual ESV terminals.³³ PanAmSat suggests that the Commission recently addressed this issue in the context of revising its earth station licensing rules and adopted a similar requirement in that proceeding, but that ESV applicants should submit a detailed technical showing regarding transmit power management if the Commission does not impose uniform, reduced transmit power limits on simultaneously transmitting ESVs.³⁴

Boeing submits that neither the *ESV Order* nor the Commission’s recent Part 25 streamlining decision contemplates dynamic uplink power control for simultaneous earth station

³¹ See MTN Opposition at 4.

³² See Boeing Petition at 16-18.

³³ See *ESV Order* at ¶ 55 n.154.

³⁴ See PanAmSat Opposition at 2-3.

uplink transmissions.³⁵ As a result, Boeing disagrees with PanAmSat that the Commission has affirmatively concluded that the $10\log(N)$ power reduction formulation is the only appropriate method of complying with the aggregate off-axis EIRP limits for simultaneously transmitting ESV terminals. As previously stated, this would severely restrict bandwidth-on-demand systems where different terminals operate at different e.i.r.p. levels, and might also preclude systems of multiple terminal classes that include some high-power/ high data-rate “premium” terminals and some low-power/low data-rate “economy” terminals.

Boeing agrees with PanAmSat, however, that it is incumbent on the ESV applicant to demonstrate adequately how it will comply with the ESV off-axis e.i.r.p. spectral density mask. For some basic systems, this could take the form of a $10\log(N)$ formulation. For systems with more complex transmit power management approaches, detailed control information would need to be provided. In any event, ESV applicants would need to show that an individual ESV can comply with the off-axis limits. While Boeing does not believe that additional rules must be developed regarding the sufficiency of the showing, the technical information submitted by ESV applicants plainly should be sufficient for the Commission to conclude that the proposed operations are consistent with the ESV rules.

³⁵ See Boeing Petition at 16-18; *see also* 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission’s Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Sixth Report and Order and Third Further Notice of Proposed Rulemaking*, IB Docket No. 00-248, FCC 05-62 (rel. March 15, 2005) at ¶¶ 51-70.

V. CONCLUSION

For the foregoing reasons, Boeing respectfully requests that the Commission clarify and/or reconsider its *ESV Order* as suggested in the Boeing Petition, Opposition and this submission.

Respectfully submitted,

/s/

R. Craig Holman
Counsel
The Boeing Company
Connexion by Boeing
P.O. Box 3707, MC 14-07
Seattle, WA 98124-2207
(206) 655-5399

Philip L. Malet
Carlos M. Nalda
Step toe & Johnson LLP
1330 Connecticut Avenue, NW
Washington, DC 20036
(202) 429-3000
Counsel for The Boeing Company

Dated: May 4, 2005

CERTIFICATE OF SERVICE

I, Lee C. Milstein, hereby declare that copies of the foregoing Consolidated Reply to Oppositions and Comments of the Boeing Company were sent on this 4th day of May, 2005 by United States Postal Service first-class mail to the following:

John L. Bartlett
Carl R. Frank
Wiley Rein & Fielding LLP
1776 K Street, N.W.
Washington, D.C. 20006

Counsel for ARINC Incorporated

Susan H. Crandall
Assistant General Counsel
Intelsat Global Service Corporation
3400 International Drive, N.W.
Washington, D.C. 20008

Joseph A. Godles
Goldberg, Godles, Wiener & Wright
1229 Nineteenth Street, N.W.
Washington, D.C. 20036

Counsel for PanAmSat Corporation

Raul R. Rodriguez
Stephen D. Baruch
Philip A. Bonomo
Leventhal Senter & Lerman PLC
2000 K Street, NW
Suite 600
Washington, D.C. 20006

*Counsel for Marine Telecommunications
Network, Inc.*

/s/

Lee C. Milstein